

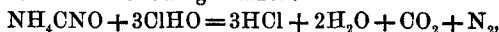
QUARTERLY SUMMARY
OF THE
IMPROVEMENTS AND DISCOVERIES
IN THE
MEDICAL SCIENCES.

ANATOMY AND PHYSIOLOGY.

1. *A Simple Process for Estimating Urea in the Urine.*—With the exception of the yeast process for the estimation of sugar, there has been up to the present time no accurate method adapted for clinical use by which it was possible to make quantitative determinations of the various constituents in the urine. Of the normal constituents urea is by far the most important; yet Liebig's method, which is that commonly used for its estimation, is so lengthy and elaborate as practically to be useless for clinical purposes.

The following method devised by W. J. RUSSELL, Ph.D., F.R.S., and SAMUEL WEST, B.A. Oxon., (*Practitioner*, Feb. 1875) is based upon a chemical reaction which has been long known, but which has not hitherto been available for general use, on account of the elaborate calculations which had to be made with every experiment. With the present form of apparatus these difficulties have been overcome, and accurate results can be obtained by it in a very few minutes. The apparatus is, moreover, easy to use, and inexpensive, and its various parts can, if broken, be replaced separately at a very slight cost.¹

Urea, as was first shown by Dr. Davy, is decomposed by hypochlorous or hypobromous acid in the following manner:—



that is to say, it is split up into water, carbonic acid, and nitrogen. If the carbonic acid be now absorbed by passing it through a solution of caustic soda, the gas evolved will be nitrogen alone. Davy proposed to measure this nitrogen and from it to determine the quantity of urea which had been decomposed, according to the formulâ:—

60 parts by weight of urea = 28 parts by weight of nitrogen.

The decomposition is not quite so complete in reality as he stated. Sixty parts of urea by weight really produce only about twenty-six parts by weight of nitrogen; that is to say, there is a loss of about eight per cent. The importance of this loss of nitrogen we shall refer to later.

The reagent employed is a solution of hypobromite of soda in considerable excess of caustic soda; and the most convenient strength of solution is found to be that prepared by dissolving 100 grammes (3½ ozs.) of caustic soda in 250 c. c. (9 ozs.) of water, and adding to this, when cold, 25 c. c. (7 drachms) of bromine.

The solution unfortunately decomposes if kept for some little time, and it is safer to make it in small quantities as it is required. This may be easily and

¹ The apparatus is sold by Messrs. Cetti, Brook Street, Holborn, price 8s. 6d.

quickly done by keeping in stock a solution of caustic soda of the necessary strength, and adding to a portion of this the requisite quantity of bromine at the time the experiment is made.

The apparatus, the form of which is shown in the accompanying sketch, consists essentially of three parts—a tube, A, in which the reaction takes place; a measuring tube, F, to collect the gas produced; and a small pneumatic trough, C D.

The tube A, about nine inches long, is narrowed two inches from the closed end, and a bulb, B, holding about 12 c. c., blown on it. The upper part of the tube contains about 25 c. c. This is fitted, by means of an India-rubber cork, into the small elliptic tin trough, C D, about three inches long, standing upon three legs. In using the apparatus, a 5 c. c. pipette is filled with the urine, and the liquid is allowed to flow into the bulb of this tube. Water is added, thus washing down the urine which adheres to the sides of the tube, and filling the bulb up to the top of the constriction. A glass rod, with a piece of India-rubber tubing about half an inch long drawn over the end of it, is then introduced, so that the India-rubber plugs up the constriction. The hypobromite solution is then poured into the upper part of the tube until it is full, and the trough is afterwards half filled with ordinary water.

The graduated tube, F, is filled with water, the thumb placed on the open end, and the tube is inverted in this trough. The glass rod is then pulled out, and the graduated tube slipped over the mouth of the bulb-tube.

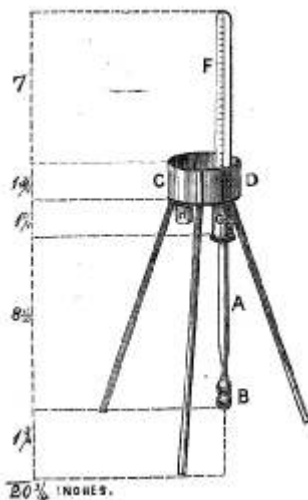
The reaction commences immediately, and a torrent of gas rises into the measuring tube. With the strength of hypobromite solution which we suggest, the reaction is complete in the cold in about ten or fifteen minutes; but in order to expedite it, the bulb is slightly warmed. This causes the mixing to take place more rapidly, and the reaction is then complete in five minutes. The reaction will be rapid and complete only when there is considerable excess of the hypobromite present. After the reaction the liquid should still have the characteristic colour of the hypobromite solution.

The simplest means of supporting the measuring tube is to have the bulb-tube corked into a well, G, which projects from the bottom of the trough about an inch downwards. The graduated tube stands over the bulb-tube, is supported by it, and rests upon the cork in the bottom of the well. It is convenient to have at the other end of the trough another well H, which will form a support for the measuring tube when not in use.

The gas collected is nitrogen saturated with aqueous vapour, and the bulb will obviously be more or less affected by temperature and pressure.

It has hitherto been necessary to make correction by calculations of some intricacy for the variations in the bulk of gas which these produce; but with the present form of apparatus it is found that these corrections may be avoided, and the volume of gas read off at once without calculation. The reason of this is the following:

When urea is decomposed by hypobromous acid, the whole of the nitrogen, as stated above, is not given off, but there is a loss of 8 per cent. at 60° Fahr., which is about the ordinary temperature of wards: however, the increase in the bulk of gas caused by the temperature, moisture, and pressure, amounts exactly to 8 per cent.; that is to say, the increase due to these causes exactly equals the loss of nitrogen due to the incomplete decomposition. In other words, if we make no correction at all, we get exactly the quantity of gas we ought to have. Hence all calculations are avoided.



The measuring tube has upon it the figures i., ii., iii. These mean 1, 2, 3 grammes of urea in 100 c. c. of urine; i. e. 1, 2, 3 per cent., as it may be called; so that if after experiment the level of the gas stands opposite ii. on the tube, the urine experimented upon contains two per cent. of urea.

Sugar does not interfere with the reaction, and albumen only so far that the bubbles of gas take so long to subside. It is advisable therefore to remove the albumen by boiling quickly with a few drops of acetic acid, and to filter. 5 c. c. of the filtrate is then taken and estimated as above.

For further information as to the theory and practical working of the apparatus, reference may be made to the original paper read before the Chemical Society, and published in that Society's Journal for August, 1874.

2. *Vaso-Motor Apparatus*.—In an able series of lectures recently published, M. VULPIAN has discussed, with great detail, the anatomy and functions of the vaso-motor apparatus of nerves—that *terra incognita* of physiology and medicine. M. Raymond, in the *Progrès Médical*, page 65, gives an interesting account of M. Vulpian's views, which will incite many to a study of his work. M. Vulpian, he says, gives clinical proofs of the influence exercised by the lesions of the great sympathetic nerve on the vascular system; he afterwards enters on the question of the vaso-dilator nerves. Calling to mind that the vessels are provided with muscular fibres, arranged in an annular form, and whose contraction can only occasion a diminution of the calibre of the vessel, M. Vulpian shows that experiment has taught a singular and incontestable fact, the existence of nerves whose excitation brings on dilatation of the vessels under their influence. These nerves, of which we owe the knowledge to Claude Bernard, are named *vaso-dilators*; whilst the others have received the name of *vaso-constrictors*. M. Claude Bernard demonstrated this fact whilst repeating Ludwig's researches on the submaxillary gland. He demonstrated as to the anastomotic filament furnished to the lingual nerve by the chorda tympani, that the action of the lingual or of the glandular filaments which spring from this nerve is due, an action which consists in the arrest of the salivary secretion when the lingual is cut, and in the continuation of the secretion when the peripheric end of the cut lingual nerve is irritated; the chorda tympani is therefore a type of vaso-dilator nerves.

Claude Bernard has searched for the existence of other vaso-dilator nerves. It has seemed to him that the auriculo-temporal branch of the fifth nerve, which anastomoses with the facial, had a dilating action on the vessels of the ear, and the same was the case with the nervous filaments surrounding the carotid. Claude Bernard has further pointed out the pneumogastric as determining a dilatation of the vessels of the breast, a fact which is denied by M. Vulpian. The chorda tympani does not exercise its dilating action on the vessels of the submaxillary gland alone. M. Vulpian has demonstrated, by irrefutable experiments, that this action is extended to the vessels of the tongue.

Nerves described by M. Eckhard under the name of *nervi erigentes* are also vaso-dilators. They spring from the sacral plexus, and, with the pudic nerves, proceed to the corpus cavernosum. These latter have not any action with regard to erection, whilst the former produce it; it is probable that the irritation of the erector nerves reacts rather on the arterioles than on the areolæ of the corpus cavernosum. M. Goltz has lately endeavoured to show that the nervous centre of the erector nerves is situated in the lumbar region of the spinal cord.

Many hypotheses have been proposed to explain the action of the vaso-dilator nerves. Heidenhain's experiments have shown that atropia paralyzes the action of the chorda tympani on the secretion of the submaxillary gland; and, on the contrary, leaves intact the influence of this nerve on the vessels of the gland. M. Vulpian thence concludes that there are secretory nerves; and, indeed, how can the results of this experiment be accounted for, if the existence of these secretory nerves be not admitted? These experiments annihilate the hypothesis of the attraction of blood by the tissues. Must we see, in the action of the vaso-dilators, a phenomenon like that known in physics under the name of the *interference of light*? must an inhibitory action be admitted? M. Vulpian has adopted this last view, always making the reserve, that the vaso-dilator